Ex:

$$v_7 = 10 \text{ V}$$

$$\downarrow i_1$$

$$v_4 = 4 \text{ V}$$

$$14 \text{ }\Omega$$

$$\downarrow i_1$$

$$v_4 = 12 \text{ V}$$

$$25 \text{ V} \enspace \textcircled{\raisebox{1pt}{$+$}\!\raisebox{-1pt}{$-$}}$$

$$15 \text{ V} \enspace \textcircled{\raisebox{1pt}{$+$}\!\raisebox{-1pt}{$-$}}$$

$$\downarrow i_1$$

$$11 \text{ }\Omega$$

$$1.8 \text{ k}\Omega$$

$$6 \text{ }\Omega$$

$$v_2 = 1 \text{ V} \qquad\qquad v_2 = -3 \text{ V}$$
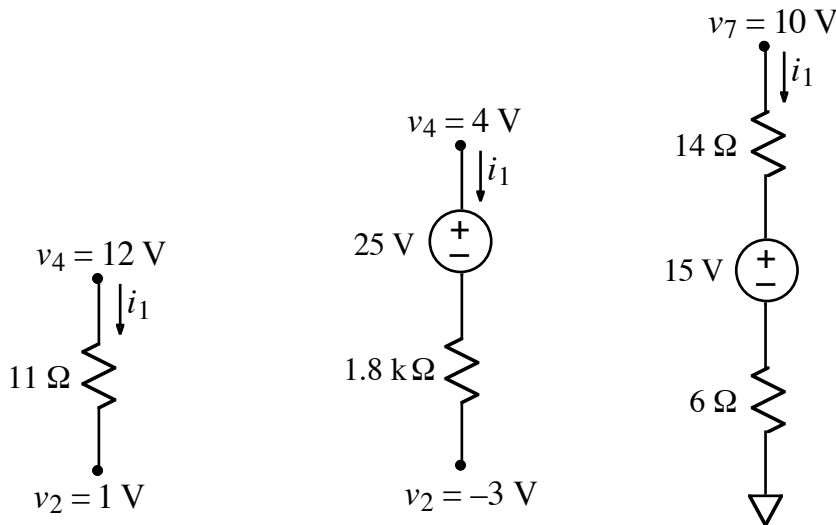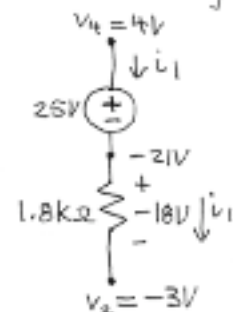
Find the value of current, i_1, for each of the above circuits.

SOL'N: The   current   for   the   circuit   on   the   left   is   given   by   Ohm's   law:
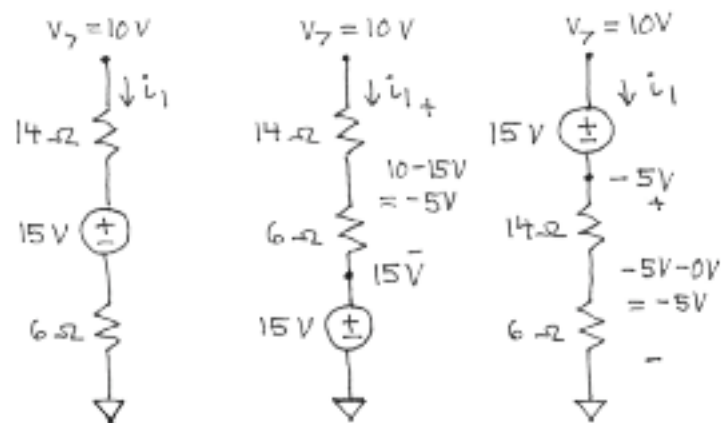
$$i_1 = \frac{12V - 1V}{11\,\Omega} = \frac{11V}{11\,\Omega} = 1 \text{ A}$$

For   the   circuit   in   the   center,   the   voltage   below   the   25V   source   is $4V - 25V = -21\cdot V$.   The   voltage   drop   across   the   1.8kΩ   is $-21V - (-3V) = -18V$.   By   Ohm's   law,   the   current   in   the   1.8 kΩ   is   the   voltage   drop   over   the   resistance:

$$i_1 = \frac{-18V}{1.8k\Omega} = -10 \text{ mA}$$

$$v_4 = 4V$$

$$\downarrow i_1$$

$$25V \textcircled{\raisebox{1pt}{$+$}\!\raisebox{-1pt}{$-$}}$$

$$-21V$$

$$+$$

$$1.8k\Omega \lessgtr -18V \downarrow i_1$$

$$-$$

$$v_2 = -3V$$

For the circuit on the right, we get the same current, i_1, if we slide resistors thru the v-source. The following three circuits have the same current, i_1.

$$V_7 = 10\,V \qquad V_7 = 10\,V \qquad V_7 = 10V$$

Combining resistors, $6\,\Omega + 14\,\Omega = 20\,\Omega$, we have the current i_1 from Ohm's law:

$$i_1 = -\frac{5V}{20\,\Omega} = -0.25\ A$$